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A. D. MELVIN, CHIEF OF BUREAU.

POULTRY INVESTIGATIONS
AT THE
MAINE AGRICULTURAL EXPERIMENT
STATION.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., July 16, 1906.

SIR: I have the honor to transmit herewith a manuscript entitled "Poultry Investigations at the Maine Agricultural Experiment Station," by Profs. Charles D. Woods and Gilbert M. Gowell, of that station. This is a revision of Bulletin No. 100 of the Maine Station, and describes the methods used there in poultry breeding and management. This work is now being done in cooperation with this Bureau. As the results already accomplished are of great value to poultrymen and there is a general demand for information as to the methods employed, I recommend the publication of this paper as a bulletin of this Bureau.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
Introductory.....	7
Breeding for increased egg production	7
Pedigree charts	9
Selection of breeding stock.....	11
Method used at the Maine Station.....	11
Other methods of selecting breeding stock.....	14
Early laying a valuable indication.....	15
Poultry management	16
Raising chickens by natural processes.....	16
Raising chickens by artificial processes	18
The incubator.....	18
The incubator room	19
Brooder houses	19
Treatment of young chicks.....	21
Feeding the chicks	22
Feeding chickens on the range	23
The feeding trough.....	24
Feeding the cockerels for market.....	25
Housing the hens	27
The warmed house	27
The roosting-closet house	28
Curtain-front houses.....	29
The latest form of curtain-front house.....	32
Satisfactory results with curtain-front houses.....	35
The yards	35
Trap nests	36
Feeding the hens.....	37
Cracked corn and beef scrap as a substitute for moist mash.....	38
Dry feeding.....	39
Size of flocks and housing space.....	41

ILLUSTRATIONS.

PLATES.

	Page.
PLATE 1. Fig. 1.—Incubator house. Fig. 2.—Pioneer roosting-closet house...	20
2. Brooder houses on the range	20
3. Poultry houses	28
4. Interior of curtain-front poultry house No. 2	30
5. The latest curtain-front poultry house	32

TEXT FIGURES.

FIG. 1. Chicken feeding trough, accessible from both sides, with cover on....	24
2. Chicken feeding trough with cover removed	25

POULTRY INVESTIGATIONS AT THE MAINE AGRICULTURAL EXPERIMENT STATION.

INTRODUCTORY.

For many years poultry work has been carried on at the University of Maine. It was not, however, until 1897 that the Maine Experiment Station decided to begin a series of poultry investigations on a somewhat extended scale. Since 1904 this work has been carried on in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. The details of the results will be published, when completed, in a bulletin of this Bureau. Although the principal object of the present bulletin is to state the methods of poultry management practiced at the Maine Experiment Station, it may not be amiss, because of the great interest which has developed in the matter, to report here a brief summary of the results thus far obtained in the experiments in breeding for egg production.

In 1897 the Maine Station erected a poultry house 150 feet by 16 feet, a brooder house 60 feet by 14 feet, and a half dozen small movable brooder houses. The plant was constructed for the purpose of investigation, and many experiments, chiefly feeding, were under way in the winter of 1897-98. Early in the spring of 1898 this poultry plant was entirely destroyed by fire, but the larger part of the stock was saved. Of course the experiments thus interrupted did not give definite results, but the records of the pens and careful observation of the birds showed marked differences in the egg production, which led to a change in the plan and scope of the investigations. These birds were from stock that had been bred at the experiment station for many years.

BREEDING FOR INCREASED EGG PRODUCTION.

When the poultry plant was rebuilt in 1898 it was decided to give up for the present definite feeding experiments and to confine the work of the station for several years to the problem: Can egg production be increased by breeding and selection? This work, which was begun in 1898, has been continued without interruption.

In breeding poultry such wonderful changes have been made in form and feather that it seems to have been demonstrated that at least in these particulars the laws of inheritance and transmission are as true with poultry as with cattle, sheep, and horses. Many attempts have been made to improve egg production by breeding. This work has

been done mostly with flocks rather than with individual fowls, in much the same way as if an attempt were made to improve the milk production of a herd by basing the breeding upon the milk and butter production of the herd as a whole, without reference to the work of the individual animals. While numerous related problems have arisen in connection with the work and some side questions have been studied, nothing has been allowed to interfere with the original plan of breeding for increased egg production.

This work was begun with three different varieties—Barred Plymouth Rock, White Wyandotte, and Light Brahma. With the particular strains at the Maine Station, the Barred Plymouth Rock seemed the most promising, and, as the problems became complicated, the work was reduced to this one variety.

The plans followed in this breeding work are based upon everyday, practical common sense, and are the same as would be used in building up a high-producing strain of dairy animals. Individual records of performance are kept. The large producers are mated with sons of large producers in the hope of obtaining a race of improved layers. In the first year's work three birds laid over 200 eggs each, and this fact led to the adoption of that number of eggs as the minimum performance for a "registered" bird. Other than this there was no reason for selecting 200 as the number of eggs necessary to entitle a bird to registration. Any other number, as 190 or 210, might have been taken with equal propriety, just as horsemen might have selected some other time than 2.30 by which to determine a standard horse.

The purpose of this work should not be misunderstood. It was not attempted to breed stock that would average a yield of 200 eggs per year. This is a high record—much higher, probably, than large flocks will be made to average. If the average yield of the hens of the breed should be increased to the extent of a dozen eggs per bird the value of the work would be many times its cost.

In this investigation inbreeding is strictly guarded against, as it is doubtful if the inbred hen has sufficient constitution to enable her to withstand the demands of heavy egg yielding. During only one season have birds as closely related as first cousins been bred together. Line breeding is followed, the matings now being only with distantly related birds. These breeding investigations have been in progress for seven years. The first year was consumed in testing pullets to find foundation stock. The second year cockerels were raised from the large-laying hens for future breeding, and the third year the first lots of pullets were raised from the selected stock, so that there are only the last four years in which to note results, and these four years can only show the first changes that have taken place. The stock commenced with was well bred, as flocks generally go. The hens averaged about 120 good brown eggs a year, and had been doing so for several years.

PEDIGREE CHARTS.

In order to make clear the methods of breeding and registering employed, there are given two pedigree charts which illustrate the breeding of the two classes of birds which are designated as "registered" and "unregistered." These terms are not used with reference to purity of blood, for the strain used is one of the oldest of the families of Barred Plymouth Rocks, having been bred at the University of Maine for twenty-five years from the best "Barred Rock" stock which was procurable at the time of starting. Every one of the birds is purebred in the same sense that all registered cattle, horses, sheep, and swine are purebred.

Each of the hens is numbered with duplicate bands, and individual book accounts are kept, whether she produces much or little. The same is true of all males so far as purity of blood is concerned.

In this work the term "registered" is used solely with reference to performance, which in work with Jersey or Holstein cattle would mean registered in the "advanced registers" of those breeds. No female has been registered unless she had laid 200 or more large dark-brown eggs during the first twelve months from the day on which she laid her first egg. None of her daughters have been registered unless they themselves had laid at least 200 eggs in their first laying year.

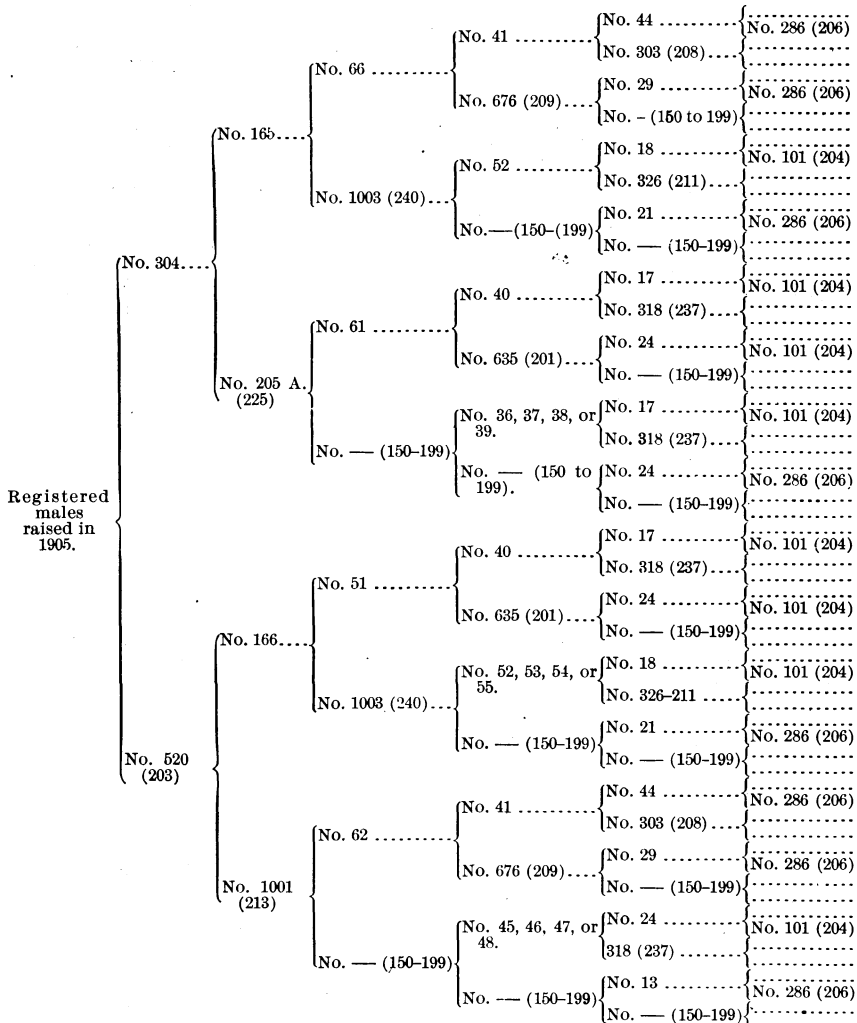
All of the sons of registered hens are registered and are designated as registered males. They are no better bred than their own sisters which are rejected from registry when they do not prove to be heavy performers. Were there some practicable means to determine the ability of the male to transmit to his offspring the high egg-producing function of his dam, the same rigid rule of selection would be applied to him that is applied to his sisters.

The unregistered cockerels and pullets are as well bred on their sires' side as the registered ones are, but, while the registered ones have dams that produced 200 eggs or over, the dams of the unregistered ones laid from 160 to 199 eggs in their first laying year. It is among these unregistered pullets that the most of the 200-egg producers that are each year added to the foundation breeding stock have been found.

The diagrams shown are given only as examples of the breeding. In the male breeding pens nearly 30 different hens are employed, which give as many different pedigrees. In the unregistered female breeding pens are several hundred breeding hens, each giving pedigrees to their progeny. In the diagram illustrating the breeding of the registered males it is shown that the dams and their dams were both producers of over 200 eggs. Only two other similar instances where the daughters of 200-egg producers are themselves 200-egg producers have been found. That more instances of this kind have not occurred is due to the fact that the hen that laid heavily her first year did not commence laying until so late the following year that her pullets came into laying too late in the year to make great records for themselves in the twelve months from November 1.

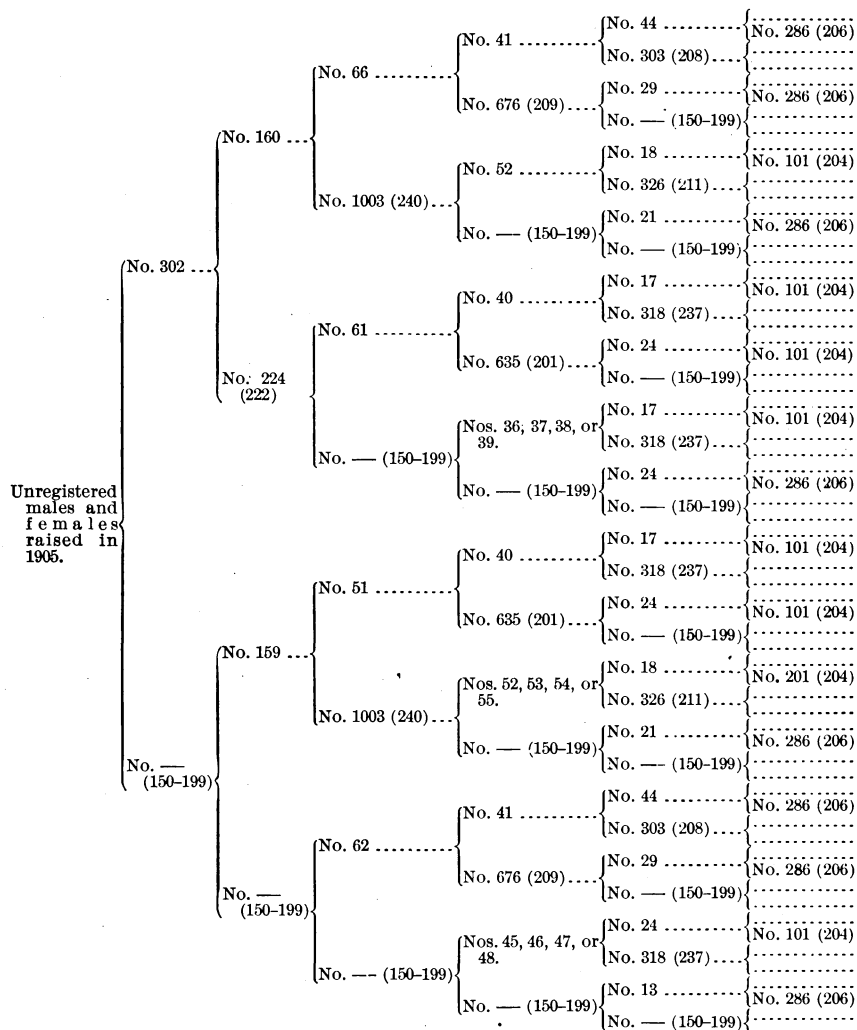
The first diagram shows the breeding of the registered males that were raised in the breeding year of 1905. The registered males are designated by numbers. It will be noted that the dam and the grandam of the registered males are registered birds in the sense in which we use the word, the dam having yielded 203 and the grandam 213 eggs in their first laying years. Beyond that, while the birds are purebred, their breeding is not known except that their dams laid not less than 160 and not more than 199 eggs in their first laying years. The breeding of the unregistered males and females raised in 1905 differs from the registered in that none of the mothers of the unregistered birds have laid over 199 eggs in their first laying year.

Diagram illustrating breeding of registered males raised in 1905.^a



^aThe upper number of each pair refers to the male (sire) and the lower number to the female (dam). The figures in parentheses below or at the right of the number of the hen indicate the egg yield for the first laying year.

Diagram illustrating breeding of unregistered males and females raised in 1905.^a



^aThe upper number of each pair refers to the male (sire) and the lower number to the female (dam). The figures in parentheses below or at the right of the numbers of the hens indicate the egg yield for the first laying year.

SELECTION OF BREEDING STOCK.

METHOD USED AT THE MAINE STATION.

In order to select good producing hens for foundation breeding stock, 52 of the trap nests described on page 36 were placed in the laying pens, where 140 pullets hatched in April and May commenced using them November 1, 1898. In one year from that date the 140 birds laid an average of 120 eggs each. Twenty-four laid over 160 each and 22 less than 100 each. Hen No. 36 laid 201 eggs; No. 101

laid 204, and No. 286 laid 206 eggs. The eggs of No. 36 were light in color,^a and she was therefore rejected as a breeder.

At the commencement of the next breeding season Nos. 101 and 286 were mated with males that were unrelated to them or to each other. The cockerels raised from the eggs of these two birds were the first males produced for use in this work.

November 1, 1899, 160 pullets were placed in the testing pens. In the year beginning with that date they laid an average of 132 eggs each. Three laid over 200 eggs, and 19 laid over 160 eggs.

In the early spring of 1901 several sons of hen No. 286, raised the previous year, were mated with the 24 2-year-old hens that each laid 160 eggs and over during 1898-99, and 25 others that each laid 160 eggs or over during the 1899-1900 test. That season (1901) hen No. 303, which had laid 208 eggs during 1899-1900, was bred to a son of No. 286. Hen No. 326 had laid 211 eggs during 1899-1900, and she also was bred to a son of No. 286. No. 318 had laid 237 good brown eggs in 1899-1900; and after she had laid 200 eggs, the next dozen she laid weighed 1 pound 11½ ounces. She was bred to a son of No. 101 that season. The sons of Nos. 101 and 286 were in service only during the spring of 1901.

During 1900-1901 100 pullets were tested for additional foundation stock and yielded an average of 132 eggs each. Twelve birds laid over 200 eggs each, the highest number being 251 eggs, laid by hen No. 617. In the same pens were six others that laid only from 23 to 70 eggs each. Thirty-seven laid over 160 each. No hens were used as breeders that had not laid at least 160 eggs, and all, as in the previous year, were bred to males whose dams had yielded over 200 eggs.

Males were raised in 1902, for the male breeding pens of the next year, from hens No. 635 (record, 201 eggs) and No. 676 (record, 209 eggs). The eggs from both of these hens were very large and dark brown. These hens were mated to sons of No. 303 and No. 318, before mentioned. Males for the pullet breeding pens of the next year were bred from other matings of hens that had produced 200 eggs with males whose dams had yielded over 200 eggs.

In the year 1901-2 the registered stock had increased to such an extent that there was only room to house 53 pullets for testing. They were the first pullets tested that were sired by males bred from 200-egg-producing hens, and show the first results of the breeding practiced. They had been laying quite heavily out on their summer range during September and October, although they were not hatched until April and May. The 53 birds laid 7,952 eggs in the year beginning November 1, 1901—a little better than 150 eggs each. Seven of the

^aOnly hens laying large dark brown eggs have been used in these breeding experiments.

53 showed records of from 201 to 240 eggs in the year, and 23 of the 53 laid over 160 eggs each.

During the breeding season of 1903 hens No. 1001 (record, 213 eggs), No. 1003 (240 eggs), No. 1005 (222 eggs), and No. 1140 (211 eggs) were bred to male birds raised the year before whose dams had yielded over 220 eggs each, for the purpose of procuring males for the breeding pens of 1904.

All pullets raised that year (1902) were, as in the preceding three years, the progeny of hens that had laid over 160 eggs in a year, and they had this advantage over their predecessors—that their dams and maternal grandams were sired by males whose dams had yielded 200 eggs or over.

That year (1902–3) 160 pullets were tested in the trap nests. They laid 21,202 eggs, an average of 132 each. Forty-four laid over 160 eggs each, 8 laid 200 or over, viz, 200, 205, 210, 217, 220, 221, 222, and 225 eggs each. An explanation for the lower average yield than that of the last preceding year is readily found. The pullets were hatched in April and May, and, thinking to have them in readiness for laying early in November, they were fed more beef scrap than usual during the growing season while they were out on the range. This so hastened their development that they began laying in August, and they were nearly all laying heavily during September, October, and November. They were splendid birds, but almost every one of them completely molted in December, and very few eggs were had from them for more than two months; most of the eggs secured from them were laid after the middle of January. Had they commenced laying in October and continued for a year, molting would probably have been avoided and the showing would have been much better.

The breeding season of 1904 opened with 170 4-year-old hens that had laid above 160 eggs each the year before, 80 pullets and hens whose dams had laid over 200 eggs per year, and 28 hens that had themselves laid over 200 eggs per year. These birds were in 24 different pens, and they were bred to selected cockerels whose dams had yielded above 200 large brown eggs per year.

Among the pullets tested during the preceding year (1903) were found the following: No. 263a yielded 220 eggs; No. 225a, 220 eggs; No. 222a, 221 eggs; No. 224a, 222 eggs, and No. 205a, 225 eggs. These birds were bred during 1904 to cockerels raised in 1903 from heavy-producing dams whose other sons were never used in these breeding experiments. The mating of these 5 pairs of birds was to secure cockerels for the next year's breeding.

At the usual time (November 1, 1903) for the commencement of the yearly test of 1903–4, 300 good pullets were laying well out on the range. The construction of the building to be used for their quarters

was interfered with by a question of labor, and they remained out in their small summer homes during a wet, cold fall and early winter until December 6, 1903, when they were moved in. This delay and exposure of more than a month cut into the year's work heavily, and the average production of the 300 birds was reduced to 131 eggs each during a little less than eleven months. Eight birds yielded above 200 eggs each before the close of October, 1904.

The breeding females used in the season of 1905 were tested hens that laid from 160 to 251 eggs in a year; and 150 pullets and hens whose dams produced 200 eggs or over per year. All males used in breeding since 1901 had dams that had laid 200 eggs or more in a year.

In 1904-5, 400 pullets from hens that had laid above 160 eggs a year, and whose sires, grandsires, and great grandsires were descended from hens that yielded above 200 eggs per year, were tested by the trap nests for additional breeding stock. All of the dams of these pullets had sires and grandsires that had 200-egg-producing dams. The average egg yield of these birds for the twelve months beginning November 1, 1904, was 147. Among them were 54 hens that laid over 200 eggs and 217 hens that laid over 160 eggs. The highest yield by any bird in 1904-5 was 239 eggs.

The stock with which this investigation began was well bred, as flocks generally go. The hens were averaging about 120 good brown eggs a year, and had been doing so for several years. In the year 1901-2, 50 selected birds averaged 150 eggs. In the two years 1902-3 and 1903-4, with the great setbacks caused as above indicated, which was no fault of the stock, the average was 132 eggs. The average from the 400 pullets in the testing pens in 1904-5 was 147 eggs. These were not selected birds, but were a fair average of all pullets raised that year. The stock was strong and vigorous and but few chickens that hatched were lost. The hardihood and vigor of the stock is shown by the fact that many cockerels have been sold to farmers and poultrymen during the past few years and many have ordered again, with the frequent comment that their pullets are laying earlier in the season and giving better eggs than they have ever done before.

As the housing, treatment, and food have been as nearly alike as possible, there seems to be reason for assuming that the increased flock yields are the results of the breeding practiced.

It may be contended that sufficient time has not yet elapsed since the beginning of these breeding tests to warrant the claim that increased productiveness has been established, but the outlook is certainly very encouraging.

OTHER METHODS OF SELECTING BREEDING STOCK.

There are two or three much-advertised methods of judging a hen's productiveness from certain signs and marks, the secret of which will

be disclosed by the inventor for a consideration. The Maine Station has not invested in nor investigated any of these methods. There may be ways to prophesy accurately what a hen will do in the way of egg production, but they have not come to the writer's attention.

EARLY LAYING A VALUABLE INDICATION.

The only absolutely sure way of making selection for breeding stock is by aid of the data obtained by the use of trap nests. Only investigators and an occasional poultryman, however, can afford the equipment and the expense involved in operating trap nests, but every poultryman can, by closely observing his young stock during the autumn, select the pullets that are commencing or preparing to lay, and secure for the next season's breeding a pen of birds that have the function of egg production so strongly developed that they give evidence of it by its early exercise.

As evidence of the value of early-laying pullets for breeders, attention is called to the work performed by 29 April-hatched pullets that were selected from among their sisters out on the range in August and September, when they showed that they were laying or about to begin laying. They were not selected because of form or type as indicating egg production, but they were either just picked up as they were found on the nests or taken because their combs were red or because they tagged the attendant around and prated in the everyday hen language about the work they were soon going to do. They were carried to the laying house, marked with bands, and given access to trap nests.

Four of these hens died within the year. The smallest layer of the remaining 25 laid 137 eggs the first laying year; 18 laid more than 160 eggs; and 8 laid over 200 eggs, and the average of the flock for the twelve months ending August 30, 1905, was 180 eggs. This average was much higher than that of all the pullets carried that year, and the flock contained no poor layers, but a phenomenal number of high layers. The high average of the flock and the large proportion of good layers point out the advantages of this method of selection when the use of trap nests, or other equally reliable methods of selection, is not practicable.

Early maturity in pullets is generally accompanied by physical vigor, and, when the function of such birds is to produce eggs and they give evidence of it, they are certainly the best of their race to breed winter egg producers from, if we accept past experiences as a guide.

The records of a full year's laying in trap nests would be better, as that would enable the rejection of all poor workers. As the birds would not be used for breeding purposes until the year following, they would be more mature, and the chicks would be larger when hatched and would develop into larger birds at maturity than they

would if their dams were doing their first year's laying. The differences in size from these causes have been very noticeable in our work.

Poultrymen are generally desirous of securing as many well-bred pullets as possible, and so use 1-year-old hens as breeders in addition to their 2-year-olds. The work done by pullets from September to February or March is a pretty good indication of their usefulness, and their eggs are available for breeding during the pullet year. While the chickens from such eggs are not generally so large at maturity as those from older hens, they do not appear to lack constitution or vigor, and there is no apparent reason why they are not desirable for breeding purposes.

POULTRY MANAGEMENT.

Many years' practical experience in raising and keeping poultry and investigations in poultry breeding at the Maine Experiment Station have resulted in the accumulation of a considerable fund of information on poultry management. It is the purpose of the following pages to outline this experience for the benefit of poultry keepers and thereby to help them to discriminate between some of the wrong theories which have underlain much of the common practice of the past and the better theories which underlie other and newer methods that are now yielding more satisfactory results. It may be that these methods are no better than those practiced by others, but the attempt is made to state concisely the methods which have been or are now being successfully employed at the station.

RAISING CHICKENS BY NATURAL PROCESSES.

While even the small grower of chickens is earnestly urged to use an incubator for hatching, circumstances sometimes make it necessary to hatch and raise chickens by aid of the mother hen. To persons so situated an outline of the method practiced at the station before incubators had reached their present development may be helpful. An unused tie-up in a barn was taken for the incubating room and a platform was made along the inner side. The platform was 3 feet above the floor and was $2\frac{1}{2}$ feet wide and 50 feet long. It was divided into fifty little stalls or nests, each 1 foot wide, 2 feet long, and 1 foot high. This left a 6-inch walk along the front of the nests for the hens to light on when flying up from the floor. Each nest had a door made of laths at the front, so as to give ventilation. The door was hinged at the bottom and turned outward. Across the center of each nest a low partition was placed, so that the nesting material would be kept in the back end—the nest proper. For early spring work paper was put in the bottom of the nest, then an inch or two of dry earth, and on that the nest, made of soft hay.

Whenever half a dozen hens became broody they were taken in from the henhouse and put on the nests, each nest having a dummy egg in it; the covers were then shut up, and nearly every hen seemed contented. In a day or two 13 eggs were placed under each hen. Every morning the hens were liberated as soon as it was light, when they would come down of their own accord and burrow in the dry dust on the floor, eat, drink, and exercise, and in twelve or fifteen minutes they would nearly all go onto the nests voluntarily. In the afternoons one would occasionally be found off the eggs looking out through the slatted door. If she persisted in coming off she was exchanged for a better sitter. The double nest is necessary, otherwise the discontented hen would have no room to stand up, except on her nest full of eggs, and she would very likely ruin them. There was no danger of this with the double nest, as she would step off the nest, go to the door and try to get out.

The advantages of a closed room in which to confine the sitters are many, as the hens are easily controlled and do not need watching as they do when selecting nests for themselves, or when sitting in the same room with laying hens. A room 12 feet square could be arranged so as easily to accommodate 50 sitters.

The most satisfactory arrangement used at the Maine Station for the accommodation of the hen with her brood of young chicks consisted of a closed coop about 30 inches square, with a hinged roof and a movable floor in two parts, which would be lifted out each day for cleaning. This little coop had a wire-covered yard attached to it on the south side. The yard was 4 by 5 feet in size and $1\frac{1}{2}$ feet high. Its frame was of 1-inch by 3-inch strips and was fastened securely to the coop.

The wire on the sides was of 1-inch mesh, but on top 2-inch mesh was sufficient. Such a coop is easily kept clean, and the coop and yard can be set over onto clean grass by one person.

The small run will be sufficient for the first few weeks, but soon the chicks need greater range, and then the fence at the farther end of the run can be lifted up 3 or 4 inches and they can pass in and out at will, while the mother will be secure at home and they will know where to find her when they get cold or damp or need brooding. Such a coop accommodates 15 to 20 chicks until they no longer require brooding, after which several flocks should be combined in one and put in a portable house on a grassy range.

Whenever the hen is allowed to hatch or to mother chicks, much care must be exercised to prevent lice from getting a foothold and ruining the birds. The free and frequent use of fresh insect powder upon the hen, working it through the feathers to the skin, is one of the best methods for destroying the pests. Grease or oil are effective when applied to the heads and under the wings of young chicks, but

care must be taken not to get too much on them, especially during damp weather. The feeding of chicks raised in coops with their mothers does not vary much from the feeding of those raised in brooders as described on page 20.

RAISING CHICKENS BY ARTIFICIAL PROCESSES.

Incubators have been so much improved that there are several kinds on the market that will hatch as many chicks from a given lot of eggs as can be done by selected broody hens. They require little care, maintain an even temperature, and are easily adjusted to meet the increase in temperature arising from the developments going on in the eggs. In some machines the moisture supply is automatic and adapted to the requirements; in others it has to be supplied, and skill is necessary in determining the quantity needed. The economy of the incubator is very great. A 360-egg machine will do the work of nearly 30 broody hens, and can be kept at work continually if desired.

THE INCUBATOR.

There are many makes of incubators on the market, most of which will give fairly satisfactory results. The Maine Station has not tested many makes of incubators and very likely some of the makes not tested would prove as satisfactory as the make used. Where many machines are used the hand turning of the eggs absorbs considerable time. Several turning devices have been used and equally good hatches have been obtained with them as when the eggs have been turned by hand. Machines that have artificial turning shelves will not hold quite as many eggs as when flat shelves are used, but the saving of time compensates for this.

Whatever make of incubator is used, pains should be taken to become thoroughly acquainted with the machine before the eggs are put into it. It would be desirable for a person not familiar with the use of an incubator to run the machine empty for several days before filling it. After the eggs are put in changes and adjustments should be made with the greatest care for fear of extreme results. By the use of an incubator it is possible to determine exactly the time when the chickens shall be hatched. With the strain of Barred Plymouth Rocks bred by the Maine Station it was formerly necessary to hatch the chickens in March in order to have them ready for November laying. By breeding from the best layers and hence the earliest developed birds, and by better methods of feeding and treatment, it is now possible to delay the hatching until April and the first of May and have the pullets in good laying condition the last of October and early in November. Chickens hatched in March under the present method of breeding and feeding would begin laying in August.

THE INCUBATOR ROOM.

It is important that the incubator room be so situated that it can be kept at a fairly constant temperature. On this account an underground room is usually selected. For many years the well-lighted cellar under the wing of the farmhouse was used by the Maine Station. A cold or damp cellar would, however, be poorly adapted for incubators. Ventilation is important, and where several incubators are in use artificial ventilation must be provided, in order that the machines may be furnished with clean, fresh air at all times.

In 1905 the Maine Station erected an incubator house (pl. 1, fig. 1) which practically consists of a well-made, light, airy cellar with a house for the poultryman above it. The incubator room, which occupies the entire cellar, is 30 feet square. The room is 7 feet high in the clear, 5 feet of which is below the level of the outside ground. It is lighted by six 3-light windows carrying glass 10 inches by 16 inches. The cement walls are finished smooth and the cement floor is slightly inclined toward the southeast corner where the intake of the drain is located. This enables the free use of water from hose in cleaning the room preparatory to starting the incubators. Two chimneys extend to the basement floor and contain ventilating flues that have no opening into the rooms above. Entrance to the room is through a covered outside cellar stairway leading into a shed at the rear of the building. The room now contains eighteen 360-egg machines, and by a little crowding would hold 21.

BROODER HOUSES.

The poultry plant erected by the Maine Station in 1897 included a permanent brooder house. The house was 14 feet wide by 60 feet long. Its front wall was 4 feet 10 inches high from the bottom of the sill to the top of the plate, and the back was 7 feet high. The ridge was 4 feet from the back side and 1 foot 6 inches higher than the back plate. This gave the short part of the roof back of the ridge and the long part to the front of it. The frame of the building was of 2 by 4's; it was boarded on the outside with hemlock boards, covered with paper, and shingled all over, and the building was ceiled on the inside with matched pine. This gave a 4-inch dead-air space in the walls and roof. The house also had a tight double floor with paper between. The front wall was 3 feet 8 inches high inside and the back wall 5 feet 9 inches from floor to ceiling. There was a 3½-foot door in each end; there were ten windows in the front wall, equal distances apart and 8 inches from the floor, and five windows in the back wall close up to the plate. The windows had 6 panes each of 10 by 12 inch glass, and the sash were in two parts so as to slide up and down and admit fresh air and to keep the house cool in warm weather. The windows were

all double. There were ten small doors, each 10 by 12 inches, placed close to the floor along the front wall, through which chickens could pass in and out; these doors were also double. Two galvanized iron ventilators at the top extended from the inside of the room up through the ridge and furnished sufficient ventilation during cold weather. The ventilators were regulated by means of a shut off at the ceiling.

The house was divided into ten breeding pens, each 6 feet by 10 feet 8 inches. The partitions between the pens consisted of an 8-inch board at the bottom with 3 feet of 1-inch-mesh wire above. A walk 2½ feet wide extended along the back of the building. The doors which led from the walk to the pens were made to swing both ways and were covered with wire. A brooder was placed in each pen with a lamp door opening into the walk. Each of these pens accommodated about 60 chicks in winter, or 75 in spring when they could get out into the yards. The building, being low posted, was kept warm enough in winter by the ten brooder stoves, and the temperature under the hovers was usually found in the morning about the same as it was left the night before.

This house proved to be thoroughly satisfactory, but was burned in the spring of 1897 and has not been replaced. A permanent brooder house would be indispensable for the raising of winter chickens, and a house piped for hot water would have some advantages over the one here described. The advantages are especially great when raising chickens if April or May prove to be cold or wet, for then the small houses are apt to be cold outside of the brooders. In ordinary seasons, even in Maine, little or no difficulty is experienced in raising chicks hatched in April and May in the small houses. The expenditure would be greater for the piped house, for the reason that colony houses should be provided in which the chickens may be sheltered after they leave the brooder house.

Since the burning of the house just described, the Maine Station has used small portable brooder houses (pl. 2). The small brooder houses built on runners are readily moved about, and for the work with spring-hatched chickens are preferred to the large permanent brooder house. Several styles and sizes have been used, but the following meets the needs of the station better than any other that has been tried. The houses are built on two 16-foot pieces of 4 by 6 inch timber, which serve as runners. The ends of the timbers, which project beyond the house, are chamfered on the underside to facilitate moving. The houses are 12 feet long; some of them are 6 feet and others 7 feet wide; 7 feet is the better width. They are 6 feet high in front and 4 feet high at the back. The frame is of 2 by 3 inch lumber; the floor is double boarded, and the building is boarded, papered, and shingled all over. In some localities roofing paper of good quality would be preferable to shingles for the outside covering

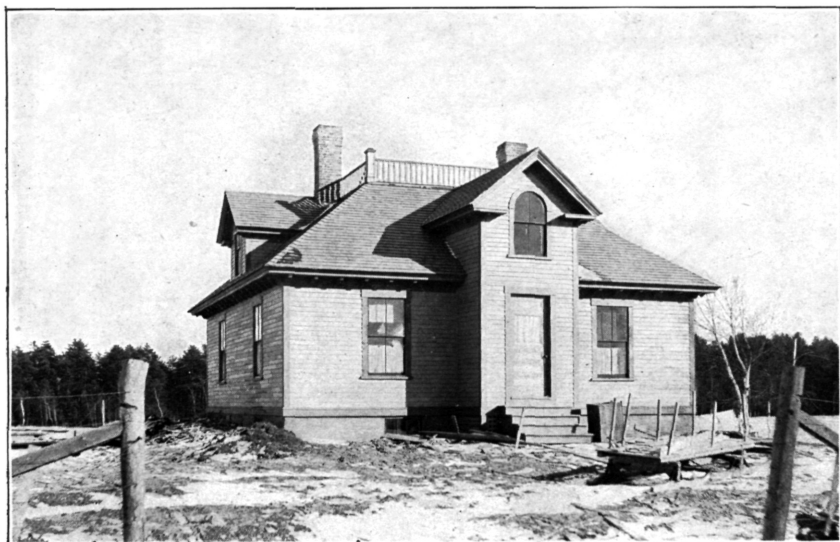


FIG. 1.--INCUBATOR HOUSE.

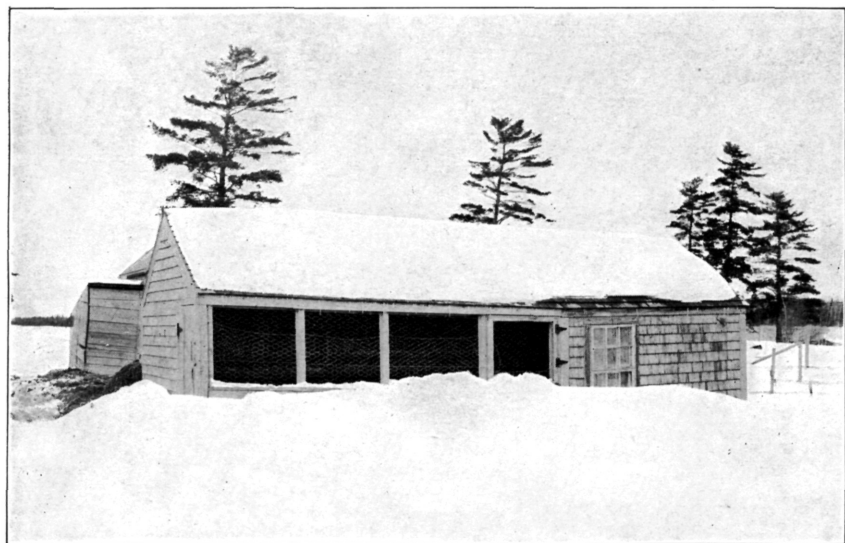


FIG. 2.—PIONEER ROOSTING-CLOSET HOUSE.



BROODER HOUSES ON THE RANGE.

of these houses. A half dozen built by the Maine Station in 1905 were covered with such roofing and are very satisfactory. This kind of covering for the wall is not so likely to be injured in moving as shingles. A door 2 feet wide is in the center of the front and a 6-light window, hinged at the top, is on each side of it. Two brooders are placed in each of these houses and 50 to 60 chicks are put with each brooder. A low partition separates the flocks while they are young, but later it has to be made higher. The houses are large enough so that a person can go in and do the work comfortably, and each one accommodates 100 chicks until the cockerels are large enough to be removed.

Indoor brooders are used at the Maine Station and are much preferred to any outside brooders the station has tried. The style used has the cover and part of one side arranged to turn down, making an inclining run the whole width of the brooder, up and down which the little chicks can go without crowding.

Most kinds of brooders as now made keep the chicks comfortable at desired temperatures and have good means of ventilation. The great difficulty lies in the lamps used. The lamp apartments are small and the tendency is for the oil to become warm and form gases which cause the flame to stream up and make trouble. Most brooder lamps have water pans between the oil tank and the burner which tend to keep the oil cool, but even with this precaution the Maine Station has had two fires, one of which was very serious. The brooders now in use have no water pans but are so arranged that currents of cool air pass constantly over the oil tank and keep its contents cool. These lamps, or stoves, have been used for four years—last year more than 20 of them—and they are apparently safe, as the oil in them has never become warm.

TREATMENT OF YOUNG CHICKS.

When the chicks are 30 to 40 hours old they are carried in warm covered baskets to the brooders, and 50 or 60 are put under each hover, where the temperature is between 95° and 100° F. The temperature is not allowed to fall below 95° F. during the first week, or 90° F. during the second week; then it is gradually reduced according to the temperature outside, care being taken not to drive the chicks out by too much heat, or cause them to crowd together under the hover because they are cold. They should flatten out separately when young, and a little later lie with their heads just at the edge of the fringe of the hover. They should never be allowed to huddle outside of the brooder. They huddle because they are cold, and they should be put under the hover to get warm, until they learn to go there of their own accord. Neither should they be allowed to stay under the hover too much, but in the daytime should be forced out into the cooler air

where they gain strength. They ought not to be allowed to get more than a foot from the hover during the first two days; then a little farther away each day, and down onto the house floor about the fourth or fifth day, if the weather is not too cold. They must not get cold enough to huddle or cry, but must come out from under the hover frequently.

The floor of the brooder is cleaned every day and kept well sprinkled with sharp, fine crushed rock, known in the market as "chicken grit." The floor of the house is covered with clover leaves or with hay chaff from the feeding floor in the cattle barns.

FEEDING THE CHICKS.

Until recently the young chicks were fed bread made by mixing 3 parts of corn meal, 1 part wheat bran, and 1 part wheat middlings or flour with skim milk or water, mixing it very dry and salting as usual for bread. It was baked thoroughly, and when well done, if it was not dry enough to crumble, it was broken up and dried out in the oven and then ground in a mortar or mill. The infertile eggs were hard boiled and ground, shell and all, in a sausage mill. About 1 part of ground egg and 4 parts of the bread crumbs were rubbed together until the egg was well divided. This bread made up about one-half of the food of the chicks until they were 5 or 6 weeks old. Eggs were always used with it for the first one or two weeks, and then fine-sifted beef scrap was mixed with the bread.

The use of bread has been given up, not because there is anything better for the young chicks, but because experiments with other methods of feeding led to the conclusion that equally good results could be obtained in other ways and with less labor. The method of feeding now used for chicks is as follows: Infertile eggs are boiled for half an hour and then ground in an ordinary meat chopper, shells included, and mixed with about six times their bulk of rolled oats by rubbing both together, enough to break the egg into small pieces. This mixture is the feed for two or three days, until the chicks have learned how to eat. It is fed sparingly, in the litter and sand on the brooder floor. When the chicks are about 4 days old they are fed a mixture of hard, fine-broken grains—i. e., cracked corn, wheat, millet, and pin-head oats—as soon as the birds can see to eat in the mornings. This is fed in the litter, being careful to limit the quantity so they will be hungry at 10 o'clock. Several of the prepared dry chick feeds have been used and found satisfactory when they are made of good clean grains and do not contain grit. The grit and charcoal can be supplied at less cost, and must be freely provided.

At 10 o'clock the rolled oats and egg mixture is fed in tin plates with low rims. After the chicks have had the feed before them five minutes the dishes are removed, and they have nothing to lunch on

except a little of the fine-broken grain, which they scratch for. At 1 o'clock the hard grains are again fed as in the morning, and at 4.30 to 5 o'clock the chicks are fed on the rolled oats and egg mixture, being given all they will eat until dark.

When the chickens are about 3 weeks old the rolled oats and egg mixture is gradually displaced by a mixture made up of 2 parts, by weight, of good clean bran, 2 parts corn meal, 1 part middlings or "red dog" flour, 1 part linseed meal, and 1 part fine beef scrap. This mixture is slightly moistened, but not enough to make it sticky, as it should crumble when a handful is squeezed and then released. By this time the birds are developed far enough to dispense with the tin plates, which are replaced by light flat troughs with low sides.

The hard, broken grains may be safely used all the way along and the fine meals left out, but the chicks do not grow so fast as when the mash is fed. There seems, however, to be least danger from looseness of the bowels when only the dry grains are fed. It is very essential that the mash be dry enough to crumble in order to avoid that difficulty. Young chicks like the moist mash better than a dry mixture and will eat more of it. There is no danger from freely using the properly made mash twice a day, and being made up largely of finely ground material the young birds can eat and digest more of it than when the food is all coarse. This is a very important fact and should be taken advantage of at the time when the young things are most susceptible to rapid growth. But the development must be moderate during the first few weeks. The digestive organs must be kept in normal condition by the use of some hard foods, and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

Clean water, charcoal, granulated bone, oyster shell, and sharp grit are always kept by them. Mangolds are cut into slices, which the chicks soon learn to peck. When the grass begins to grow they are able to get green food from the yards. If the small yards are worn out before they are moved to the range, cut green clover or rape is fed to them.

FEEDING CHICKENS ON THE RANGE.

By the middle of June the chickens that were hatched in April are being fed on cracked corn, wheat, and the mash. At about that time the portable houses with their contents of chickens are drawn from their winter locations out to an open hayfield where the crop has been harvested and the grass is short and green. (See pl. 2.) If not too much worn, the same field may be used a second season for chickens, but this is not recommended. A new, clean piece of turf land should be used each year. Two acres should be allowed for each 1,000 chickens.

When the chickens are moved to the range the sexes are separated. The methods of feeding the cockerels and pullets differ, and there has been a gradual change in the methods of feeding. Each method has given good results. The changes have been introduced to save labor. After the chickens were moved to the range they were fed in the morning and evening with a moistened mixture of corn meal, middlings, and wheat bran, to which one-tenth as much beef scrap was added. The other two feeds were of wheat and cracked corn.

In 1904 a change was made in the manner of feeding 1,400 female chickens by omitting the moist mash and keeping in separate slatted troughs cracked corn, wheat, beef scrap, cracked bone, oyster shell, and grit where they could help themselves whenever they desired to do so. Grit, bone, and oyster shell were always supplied. There were no regular hours for feeding, but care was taken that the troughs were never empty.

In 1905 another trough containing a dry mash consisting of 1 part wheat bran, 2 parts corn meal, 1 part middlings, and 1 part beef scrap was used in addition to those containing the grains. The results were satisfactory. The labor of feeding was far less than that required by any other method tried. The birds did not hang around the troughs and overeat, but helped themselves, a little at a time, and ranged off, hunting or playing, and coming back again to the food supply at the troughs when so inclined. There was no rushing or crowding about the attendant, as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap, they did not overeat of it. During the range season, from June to the close of October, the birds ate just about 1 pound of the scrap to 10 pounds of the cracked corn and wheat. This is practically the proportion eaten when the moist mash was used.

THE FEEDING TROUGH.

The difficulty of keeping the feed clean and dry during continued exposure is nearly overcome by using troughs with slatted sides and broad detachable roofs (figs. 1 and 2). The troughs are from 6 to 10

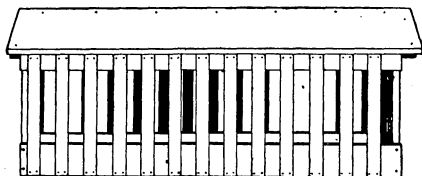


FIG. 1.—Chicken feeding trough, accessible from both sides, with cover on.

feet long, with the sides 5 inches high. The lath slats are 2 inches apart, and the troughs are 16 inches high from floor to roof. The

roofs project about 2 inches at the sides and effectually keep out the rain except when high winds prevail.

The roof is very easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests, as shown in figure 2. The trough can then be filled and the roof drawn back into

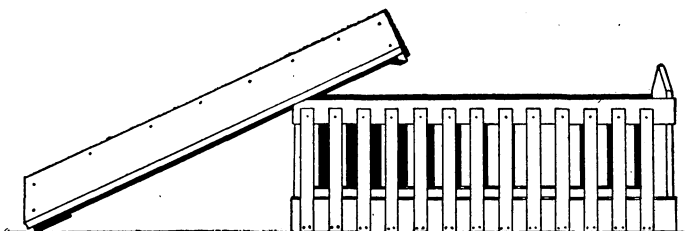


Fig. 2.—Chicken feeding trough with cover removed.

place without lifting it. This arrangement is economical of feed, keeping it in good condition and avoiding waste. When dry mash is used there may be considerable waste by the finer parts being blown away, and on this account the dry mash trough should be put in a sheltered place out of the reach of wind.

FEEDING THE COCKERELS FOR MARKET.

At the Maine Station most of the cockerels are to be used for breeding purposes, and they are fed in flocks of about 100 on the range in about the same way as the pullets. The dry-feed method is now used for them as satisfactorily as for the pullets.

A very large proportion of the cockerels raised in New England are sent to the market alive, without being fattened. Quite extended experiments at the Maine Station with many birds, in different years, indicate very clearly that keeping the cockerels for a few weeks with special feeding will add materially to the selling price. Not infrequently this will make the difference between loss from the low price obtained for slow-selling unfattened birds and the profit from comparatively quick-selling specially fed birds at a much higher price. The higher price is due partly to the increased weight and partly to the superior quality of the well-covered soft-fleshed chickens. As the bulletins containing the results of these feeding experiments with cockerels are out of print, the following brief summary of the results obtained is given:

The number of pounds of grain required to produce 1 pound of gain in fattening cockerels was ascertained in experiments comparing the effect of housing, the effect of age, and the effect of skim milk. The grain mixture used in these series of experiments was the same, consisting of 100 pounds of corn meal, 100 pounds of wheat middlings, and 40 pounds of meat meal. This was fed as a porridge thick enough to drop but not to run from a spoon.

The French and English fatteners who make a specialty of the business, fattening thousands of chickens each year, confine the chickens in small coops. Coops used at the Maine Experiment Station gave a floor space of 16 by 23 inches. They were constructed of laths with closed-end partitions of boards. The floors, sides, and tops were of laths placed three-quarters of an inch apart. By simply moving the pens thus constructed the floors were kept clean. V-shaped troughs with 3-inch sides were placed in front and about 2 inches above the level of the floors of the coops. Cockerels thus fed were compared with others kept in small houses 9 by 11 feet in size, with an attached yard 20 feet square. The yard was entirely free from anything that would serve as green food. Twenty birds were put in each of these houses.

As a result of experiments with fattening 286 birds it was found that on the average 7.9 pounds of grain were required to produce 1 pound of gain in the case of birds fed in the coops, and 5.9 pounds in the case of those fed in the small houses and yards.

An experiment with 150 birds when they were 4 months old showed that they required 4.9 pounds of grain to produce 1 pound of gain, while birds from the same stock, when they were 6 months old, required 7.4 pounds of grain to produce 1 pound of gain.

An experiment with 68 birds showed that when the porridge was wet with skim milk only 4.3 pounds of grain were required to produce 1 pound of gain, against 5.3 pounds when the porridge was wet with water. Eight pounds of skim milk was used with each pound of grain.

These experiments warrant the following conclusions: As great gains are made just as cheaply and more easily when the chickens are put into small houses and yards as when they are fed in small lots in lattice coops just large enough to hold them. Four weeks is about the limit of profitable feeding, both individually and in flocks. Chickens gain faster while young. Birds that are from 150 to 175 days old have uniformly given comparatively small gains. The practice of successful poultrymen selling chickens at the earliest marketable age is well founded. The spring chicken sold at Thanksgiving time is an expensive product. The experiments clearly indicate that it is profitable to fatten chickens in cheaply constructed sheds or in large coops with small runs for about four weeks and then send them to market dressed. In quality the well-covered, soft-fleshed chickens are so much superior to the same birds not specially prepared that the former will be sought for at a higher price. The dairy farmer is particularly well prepared to carry on this work, as he has the skim milk which these experiments show to be of so great importance in obtaining cheap rapid growth and superior quality of flesh.

HOUSING THE HENS.

When work in poultry management was first undertaken at the University of Maine the hens were kept in small colonies in accord with what was at that time believed to be the best practice. Houses 10 feet square were erected with the idea of accommodating about 15 birds each. They were well warmed and yet were apt to be damp and lined with white frost in very cold weather when the windows had to be kept shut to protect the birds from cold at night. Another disadvantage of this kind of house is its small size. A person can not care for hens in such small pens without getting them into a condition of unrest for fear of being cornered in such a small room. The question of extra labor in caring for hens in these small colonies scattered over quite a large area is an important factor in a commercial plant. When the Maine Experiment Station began experiments in 1897 a warmed house 150 feet long by 16 feet wide was erected. As before mentioned, this house was burned the next spring, but was replaced.

THE WARMED HOUSE.

This house (designated as No. 1 and illustrated in pl. 3), which was erected in 1898, is 16 feet wide by 150 feet long. It faces the south and conforms nearly to the land surface, the east end being 3 feet 6 inches lower than the west end. The sills are of 4 by 6 inch hemlock, placed flat upon a rough stone wall which rests upon the ground surface and varies from 1 to 2 feet in height. The earth is graded up to within 6 inches of the sills on the outside. The floor timbers are 2 by 8 inches, placed 2 feet 6 inches apart, and rest on the sills. The studs for the back wall are 2 by 4 inch joists, 5 feet 8 inches long, and rest on the sills. The front studs are 10 feet 6 inches long. All the studs are set 3 feet apart. Each 10 feet in length of the front of the building has one 12-light window of 10 by 12 inch glass. The top of this window comes within 1 foot of the plate. Directly underneath these windows and 6 inches above the floor are other 3-light windows of 10 by 12 inch glass. The building is boarded, papered, and shingled all over the outside, both roof and walls. The floor is of two thicknesses of hemlock boards. The entire inside of the building is papered on the studs and rafters and sheathed with matched boards. The work was carefully done and good dead-air spaces were obtained over the whole building.

The house is divided into fifteen 10-foot sections. The close partitions between the pens are 2 feet high and are made of 2-inch plank. They form strong trusses, to which the studs supporting the central plate are strongly nailed. This saves the floor from sagging from the weight of the roof when it is covered with snow. An elevated plank walk 4 feet wide runs along inside the whole length of the front of

the building and rests on the cross partitions just mentioned. The walk is 2 feet 6 inches above the floor, thus allowing the hens to pass under it and occupy the whole floor space. This part of the floor is lighted from the front by the small windows before mentioned. Above the close partition the pens are separated from each other and the walk by wire netting of 2-inch mesh. Light wooden-frame doors, covered with wire and hung with double-action spring hinges, are in every cross partition, and also in the partitions between the elevated walk and each pen.

The back ends of the cross partitions, 4 feet out from the back wall, are carried up to the roof, so as to protect the hens from currents of air while on the roosts. The roost platform is along the back wall. Four trap nests (described on page 36) are placed at the back of the house at the end of the roost platform in each pen.

All the windows are double; eight of the large outside ones are hinged at the top and kept hasped out 1 foot at the bottom, except in the roughest weather and on cold winter nights. This furnishes ventilation without drafts, as the position of the outside windows prevents strong currents of air from entering.

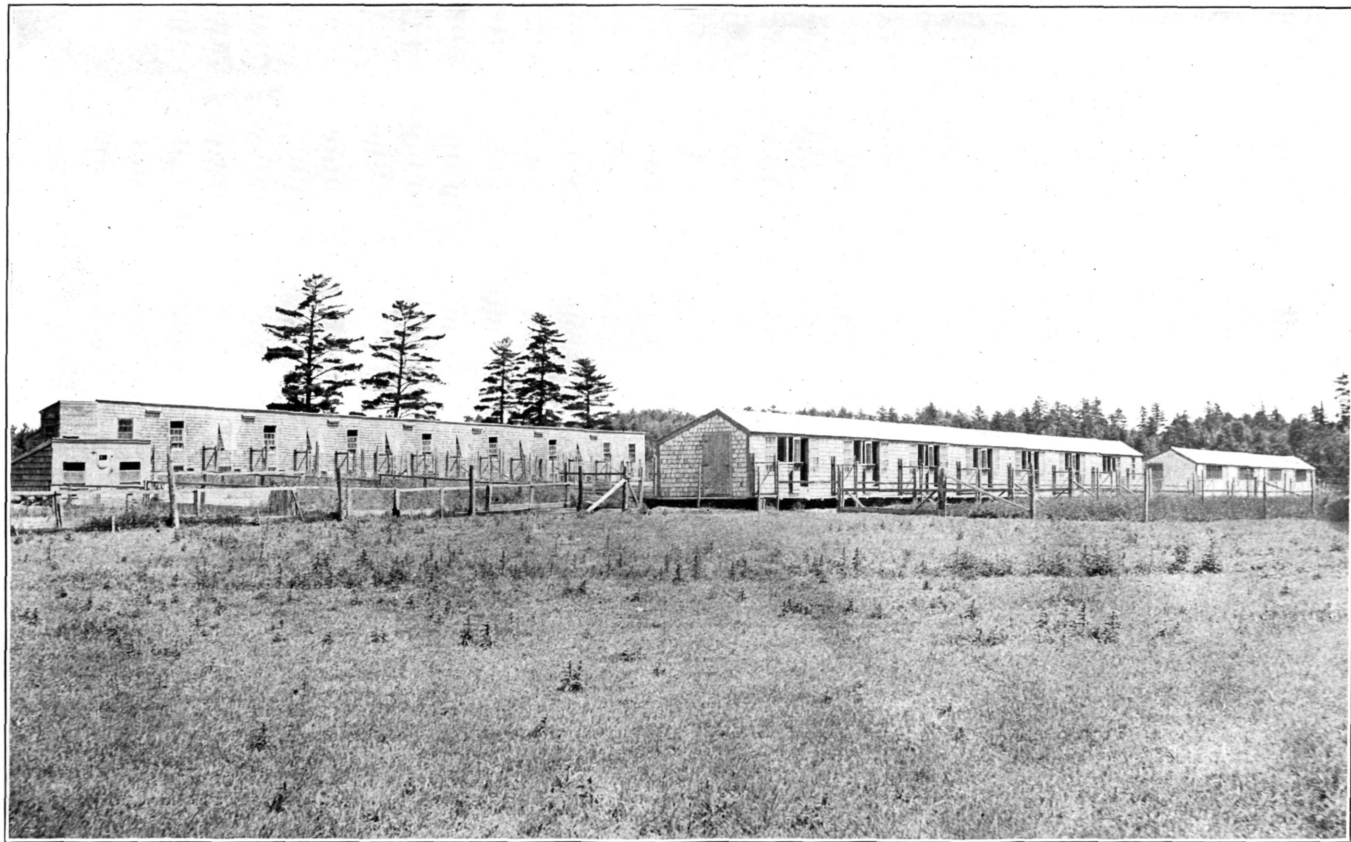
Although this house was thoroughly built, it was found necessary to close the windows during rough winter weather or water would freeze quite hard inside the building. Closing the windows caused dampness and frost on the walls, and the straw litter absorbed the moisture and became while yet clean disagreeable to the hens. A hot-water heater was placed in a pit at the lower end of the building, and one line of 2-inch pipe was carried under the roosts to the upper end of the building and returned to the boiler. By use of this heater the building is kept above the freezing point at all times, and there is not much trouble from moisture except when extremely cold weather necessitates the closing of the windows.

The birds in this house have always been in excellent health and have never shrunk in their egg yields from cold weather, except in one season when coal was not procurable and the temperature ran low.

The ease with which the hens are cared for, the availability of the entire floor space, and the welfare and productiveness of the birds kept here commend this building as one of the best. It was planned and constructed so as to obtain conditions believed to be necessary for the welfare of the birds and to economize the labor involved in their care. While a single-walled building would have cost less, it would not have kept the hens warm or given protection from the dampness which prevails in close single-walled houses.

THE ROOSTING-CLOSET HOUSE.

Five years ago one of the 10-foot square houses described above was taken for a nucleus and an addition made, so that the reconstructed



POULTRY HOUSES.

The small house at the left is a brooder house. The other houses are, from left to right, poultry houses Nos. 1, 2, and 3.

house was 10 feet wide and 25 feet long (pl. 1, fig. 2). The inside end of the old house was taken out, so that there is one room with a floor space of 250 square feet. The walls are about $5\frac{1}{2}$ feet high in the clear inside of the building. The whole of the front wall is not filled in, but a space 3 feet wide and 15 feet long is left just under the plate. This space had a frame covered with white drilling, hinged at the top on the inside, so it can be let down and buttoned during driving storms and winter nights, but hung up out of the way at all other times. The cloth of the outer curtain is oiled with hot linseed oil. The roost platform extends the whole length of the back of the room. It is 3 feet 4 inches wide and 3 feet above the floor. The back wall and up the roof for 4 feet is lined and the space filled and packed hard with fine hay. The packing also extends part way across the ends of the room.

Two roosts are used, but they do not take the whole length of the platform, a space of 4 feet at one end being reserved for a crate where broody hens can be confined until the desire for sitting is overcome. The space, from the front edge of the platform up to the roof, is covered by frame curtains of drilling, similar to the one on the front wall except that it is not oiled. They are hinged at the top edge and kept turned up out of the way during daytime, but from the commencement of cold weather until spring they are closed down every night after the hens go to roost. The hens are shut in this close roosting closet and kept there during the night, and are released as early in the morning as they can see to scratch for the grain which is sprinkled in the 8-inch deep straw on the floor.

The roosting closet has been closely observed and has never been damp or its odors offensive when opened in the mornings. There was very little freezing in the closets in the coldest weather. The birds seemed to enjoy coming out of the warm sleeping closet down into the cold straw, which was always dry, because the whole house was open to the outside air and sun every day. There were no shut-off corners of floor or closet that were damp. This building has been used through five winters with 50 hens in it. The birds have laid as well as the others in the large warmed house; their combs have been red and their plumage bright, and they have given every evidence of perfect health and vigor. While they are on the roosts they are warm. They come down to their breakfasts and spend the day in the open air. Such treatment gives vigor and snap to the human being, and it seems to work equally well with the hen.

This house, which was given the name of the "pioneer" house, is shown in plate 1, figure 2.

CURTAIN-FRONT HOUSES.

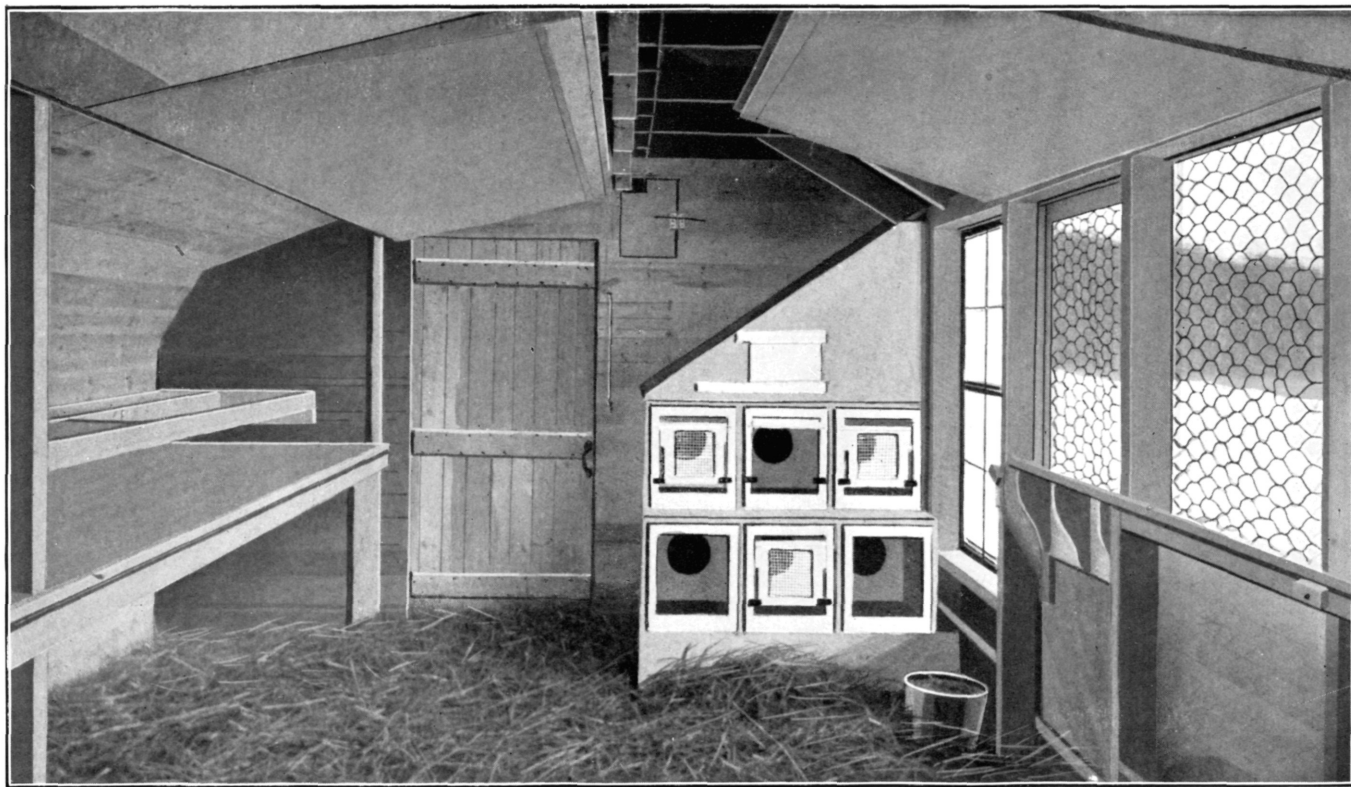
The result of the use of the "pioneer" house indicated that this was one of the right systems of treatment and housing of hens, and it

was decided to build several houses on the same plan and join them together under one roof as one house.

A curtain-front house 12 feet wide by 150 feet long, known as house No. 2 (pls. 3 and 4), was erected in 1903. The back wall is 5 feet 6 inches high from floor to top of plate inside, and the front wall is 6 feet 8 inches high. The roof is of unequal span, the ridge being 4 feet in from the front wall; and the height of the ridge above the floor is 9 feet. The sills are 4 by 6 inches in size and rest on a rough stone wall laid on the surface of the ground. A central sill gives support to the floor, which at times is quite heavily loaded with sand. The floor timbers are 2 by 8 inches in size and are placed 2 feet apart; the floor is of two thicknesses of hemlock boards. All the rest of the frame is of 2 by 4 inch stuff. The building is boarded, papered, and shingled on roof and walls. The rear wall and 4 feet of the lower part of the rear roof are ceiled on the inside of the studding and plates, and the space between inner and outer walls is packed very hard with dry sawdust. In order to make the sawdust packing continuous between the wall and roof, the wall ceiling is carried up to within 6 inches of the plate; then follows up inclining pieces of studding to the rafters, the short pieces of studding being nailed to the studs and rafters. By this arrangement there are no slack places around the plate to admit cold air. The end walls are packed in the same way. The house is divided by close-board partitions into seven 20-foot sections; one 10-foot section is reserved at the lower end for a feed-storage room.

Each of the 20-foot sections has two 12-light outside windows screwed onto the front, and the space between the windows (which is 8 feet long) for a distance of 3 feet down from the plate is covered during rough winter storms and cold nights by a light frame covered with 10-ounce duck, oiled, and closely tacked on. This door, or curtain, is hinged at the top and swings in and up to the roof when open.

In the front of each section is a door 2 feet 6 inches wide. The roost platform is at the back of each room and extends the whole 20 feet. The platform is 3 feet 6 inches wide and 3 feet above the floor. The roosts are of 2 by 3 inch stuff placed on edge and are 10 inches above the platform. The back one is 11 inches out from the wall, and the space between the two roosts is 16 inches, leaving 15 inches between the front roost and the duck curtain, which is sufficient to prevent the curtain being soiled by the birds on the roost. The two curtains in front of the roost are similar to the one in the front of the house, except that they are not oiled. They are each 10 feet long by 30 inches wide, hinged at the top, and open into the room and fasten up when not in use. Great care was exercised in constructing the roosting closets to have them as nearly air-tight as possible, except as air might come in through the cloth curtain.



INTERIOR OF CURTAIN-FRONT POULTRY HOUSE NO. 2.

Single pulleys are hung at the rafters, and, by means of a rope fastened to the lower edge of the curtain frames, it is easily raised or lowered and kept in place. At one end of the roosts a space of 3 feet is reserved as a cage for broody hens. This being behind the curtain, the birds have the same night temperature when they are transferred from the roosts to the cage.

Six trap nests are placed at one end of each room and four at the other. They are put near the front so that the light may be good for reading and recording the numbers on the leg bands of the birds. Several shelves are put on the walls 18 inches above the floor for shell, grit, bone, etc. The doors which open from one room to another throughout the building are frames covered with 10-ounce duck, so as to make them light, and are hung with double-action spring hinges. The advantages of having all doors push from the person passing through are very great; otherwise they would hinder the passage of the attendant with his baskets and pails. Strips of old rubber belting are nailed around the studs which the doors rub against as they swing to, so as just to catch and hold them from being opened by the wind. Tight board partitions are used between the pens instead of wire, so as to prevent drafts. An outside platform 3 feet wide extends across both ends and the entire front of the building.

This house accommodates 350 hens—50 in each 20-foot section—is well made of good material, and should prove to be durable. A rougher building, with plain instead of trap nests, and with the roof and walls covered with some of the prepared materials instead of shingles, could be built for less money, and would probably furnish as comfortable quarters for the birds.

Curtain-front house No. 3 (pl. 3) was constructed in 1904. It is 16 feet wide by 120 feet long, and is of the same style as No. 2, except that it is wider. There are four pens in the building, each 16 feet wide by 30 feet long. Two of the pens are arranged for 100 hens each, and two for 150 each. For the 150 hens three roosts instead of two are required.

The cloth-covered fronts of the closets where 100 and 150 hens roost are of the same size, and it became evident early in the first winter that the supply of fresh air to the largest flock was not sufficient. It was not practicable to increase materially the cloth surface and allow more air to filter in, so three openings were made in the upper part of the curtain frame, through which better ventilation could be secured. The openings are 6 inches wide by 30 inches long and are provided with wooden shutters. These are kept wide open into the outer room during mild nights, but when high winds prevail and the temperature falls to 10 or more degrees below zero the openings are half closed.

The walls of the elevated closet are packed with sawdust 4 inches in thickness, and the curtains fit very closely, leaving only small cracks.

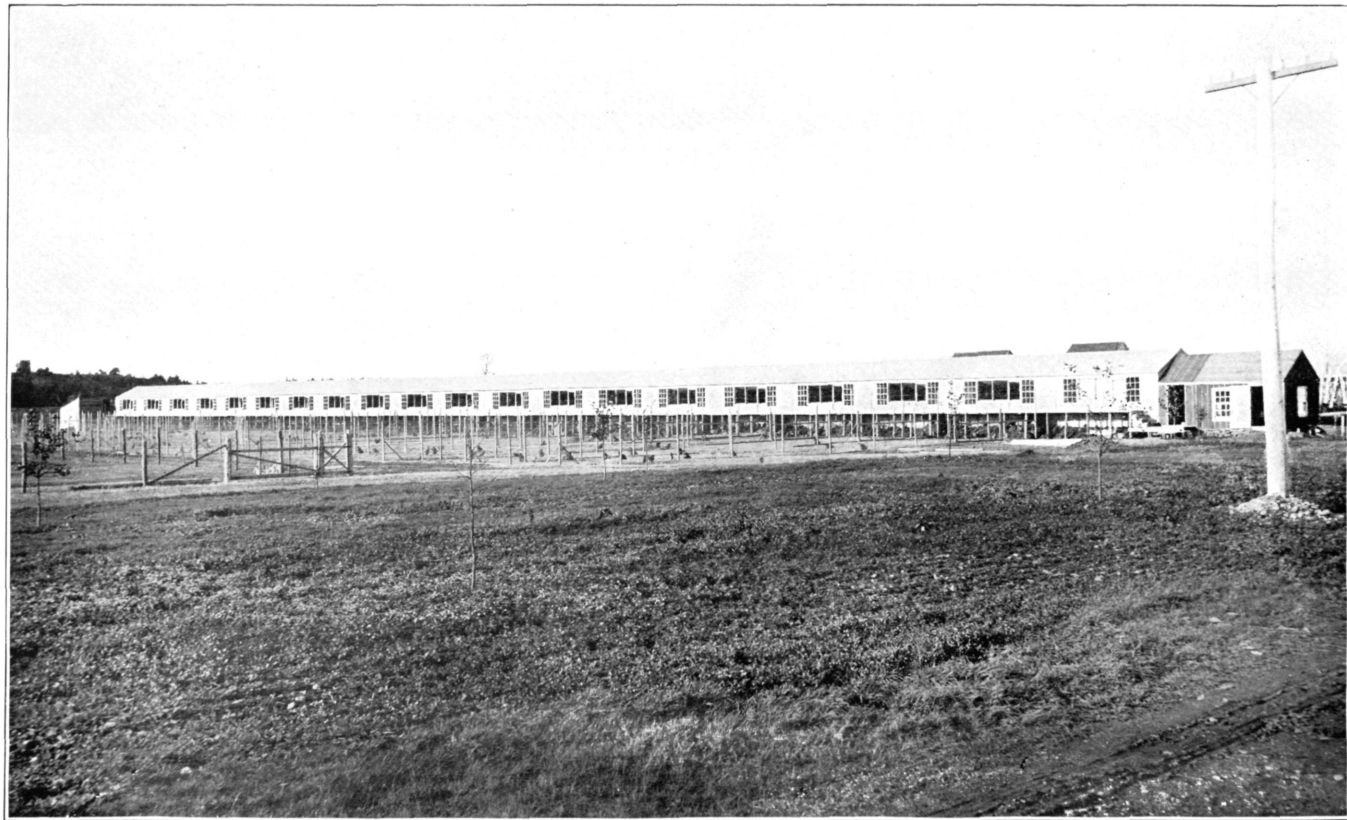
The 10-ounce duck of which the curtains are made is not oiled. The supply of fresh air is mostly admitted through the cloth, while the breathed warmer air passes off through the openings above. By this arrangement the birds are not in drafts or currents of air. Where three roosts are arranged abreast, instead of two, the openings are absolutely essential, and for smaller flocks they are convenient during the mild nights, especially toward spring.

THE LATEST FORM OF CURTAIN-FRONT HOUSE.

During the summer of 1905 the management of a commercial poultry plant in Orono built a curtain-front house to accommodate 2,000 laying hens. This was built in accordance with unpublished plans prepared by the Maine Experiment Station. The description is here given as it represents the latest development of this style of house (pl. 5).

The house is 20 feet wide by 400 feet long, and is divided into 20 sections, each being 20 feet square. It is on the same general plan as houses Nos. 2 and 3 just described, but house No. 2 is 12 feet wide, house No. 3 16 feet wide, and this one 20 feet wide. The widths have been increased in the last two houses, as experience has shown the advisability of it. At first it was thought the houses should be narrow so they might dry out readily, but the 20-foot house dries out satisfactorily, as the opening in the front is placed high up so that the sun shines in on the floor to the back in the shortest winter days.

The economy in the cost of the wide house over the narrow ones, when space is considered, is evident. The front and back walls in the narrow house cost about as much per lineal foot as those in the wide house, and the greatly increased floor space is secured by building in a strip of floor and roof running lengthwise of the building. The carrying capacity of a house 20 feet wide is 66 per cent greater than that of a house 12 feet wide, and it is secured by merely building additional floor and roof. The walls, doors, and windows remain the same as in the narrow house, except that the front wall is made a little higher. Three sills which are 6 inches square run lengthwise of the house, the central one supporting the floor timbers in the middle. They rest on a rough stone wall, high enough from the ground for dogs to go under the building to look after rats and skunks that might incline to make their homes there. The stone wall rests on the surface of the ground, and there are openings in it like cellar windows every 20 feet to allow the air to draw through and keep the basement dry during the summer. The floor timbers are 2 by 8 inches in size and rest wholly on top of the sills. All wall studs rest on the sills; the front ones are 8 feet long, and the back ones 6 feet 6 inches long. The two sides of the roof are unequal in width, the ridge being 8 feet from the front wall. The height of the ridge from the sill to the extreme top is 12 feet 6 inches. All studding is 2 by 4 inches in size and the rafters are



THE LATEST CURTAIN-FRONT POULTRY HOUSE.

2 by 5 inches. The building is boarded with 1-inch boards, and is papered and shingled with good cedar shingles on walls and roof. The floor is of two thicknesses of hemlock boards which break joints in the laying.

The building is divided by tight board partitions into twenty sections, each section being 20 feet long. All of the sections are alike in construction and arrangement. The front side of each section has two storm windows of twelve lights of 10 by 12 inch glass. These windows are screwed on upright and 2 feet 8 inches from each end of the room; they are 3 feet above the floor. The distance between the windows is 8 feet 10 inches, and the top part of it to a depth of 3 feet 6 inches from the plate is not boarded but is left open to be covered by the cloth curtain when necessary. This leaves a tight wall 3 feet 10 inches high extending from the bottom of the opening down to the floor, which prevents the wind from blowing directly on the birds when they are on the floor. A door is made in this part of the front wall for the attendant to pass through when the curtain is open. A door 16 inches high by 18 inches wide is placed close to the floor under one of the windows for the birds to pass through to the yards in front. A similar door is in the center of the back wall to admit them to the rear yard when it is used.

A light frame made of 1 by 3 inch pine strips and 1 by 6 inch cross-ties is covered with 10-ounce white duck and hinged at the top of the front opening, which it covers when closed down. This curtain is easily turned up into the room, where it is caught and held by swinging hooks until released.

The roost platform is made tight and extends along the whole length of the room against the back wall. It is 4 feet 10 inches wide and 3 feet above the floor, being high enough for a person to get under it comfortably when necessary to catch or handle the birds. There are three roosts framed together in two 10-foot sections. The tops of the roosts are 1 foot above the platform and hinged to the back wall, so they may be turned up out of the way when the platform is being cleaned. The back roost is 12 inches from the wall, and the spaces between the next two are 16 inches. They are made of 2 by 3 inch spruce lumber placed on edge with the upper corners rounded off. The roosting closet is shut off from the rest of the room by curtains similar to the one described above. For convenience in handling there are two of these curtains, each 10 feet long. They are 3 feet wide and are hinged at the top so as to be turned out and hooked up. The space above this curtain is ceiled and in it are two openings each 3 feet long and 6 inches wide for ventilating the roosting closet when necessary. In every compartment there is a door placed 5 inches out from the edge of the roost platform. These doors are 3 feet wide and 7 feet high, divided in the middle lengthwise, and each half is

hung with double-acting spring hinges allowing it to swing open both ways and close.

Ten nests are placed, in two tiers, against the partition in each end of the room. They are of ordinary form, each nesting space being 1 foot wide, 1 foot high, and 1 foot long, with the entrances near the partition, away from the light, and with hinged covers in front for the removal of the eggs. Each section of 5 nests can be taken out without disturbing anything else, cleaned, and returned. In constructing the house it was designed to use these nests only during the present year. The framework where they rest was arranged for the use of trap nests, the intention now being to install them in October of the present year (1906).

Troughs similar to those described on page 24 are used for feeding dry mash, shell, bone, grit, and charcoal.

Two lines of 4 by 4 inch spruce are arranged as an elevated track above the doors. The track extends the entire length of the building, and being faced with narrow steel bands on top, a suspended car is readily pushed along, even when heavily loaded. The car platform is 2 by 8 feet in size, and is elevated a foot above the floor. All feed and water are carried through the building on this car. Ten iron baskets, into which the accumulations on the roost platforms are cleaned every morning, are put on the car, and collections are made as the car passes on through the pens to the far end of the building, 400 feet away, where the roost cleanings are dumped into the manure shed. As the car is pushed along a guard at the front end comes in contact with the doors and pushes them open, and they remain open until the car has passed on, when the spring hinges force them to close again. This car is a great saver of labor, as it does away with nearly all carrying by the workmen. It has enabled one man to take good care of the 2,000 hens from November to March, except on Saturdays, when the litter has been removed and renewed by other men.

At one end of the building there is a temporary feed and water house, also used for dish washing and scalding, where the car remains when not in use.

There is a walk outside of the building, extending along its entire front. It is 4 feet wide, made of 2-inch plank, and is elevated 2 feet above the floor of the building, which allows the doors below it, through which the birds pass to the front yards, to be opened and closed without interference. The door which opens out of each room through the curtain section is above the outside walk and necessitates stepping up or down when passing through, which is not a very serious objection, as the door is used but little in the daily work, but mostly in the weekly cleaning out and renewing of the floor litter. A guard of wire poultry netting 1 foot wide, along the outside of the walk, prevents

the birds from flying from the yards up to the walk. The advantage of the elevated walk over one on a level with the sill of the building is that it is unobstructed by gates, which, were the low walk used, would be necessary to prevent the birds from passing from one yard to another.

SATISFACTORY RESULTS WITH CURTAIN-FRONT HOUSES.

The "pioneer" house has been in use for five years with 50 pullets in it each year, the No. 2 house three years with 300 pullets each year, the No. 3 house two years, and the house last described one year. Besides these four houses, the Maine Station has had the use of another house of the open-front style of construction for four years with about 200 1-year-old breeding hens in it each year.

Maine is subject to long spells of severe cold weather, with the temperature considerably below zero at night, and about zero during the day, and with a good deal of high wind. During such rough weather the bedding on the floor has kept comparatively dry; and the voidings on the platform, when the curtains are raised in the mornings, have been but slightly frozen. The yields of eggs during severe weather and immediately following it are rarely below those immediately preceding it. It should be borne in mind that had the weather been mild all that time the hens probably would have increased in production rather than remained stationary. They are doubtless affected by the severe weather, but not seriously, as they uniformly begin to increase in production very soon after the weather becomes normal for midwinter.

These curtain-front houses have all proved eminently satisfactory. Not a case of colds or snuffles has developed from sleeping in the warm elevated closets, with their cloth fronts, and then going directly down into the cold room, onto the dry straw, and spending the day in the open air. The egg yields per bird have been as good in these houses as in the warmed ones. The purpose of having rooms and flocks of different sizes was to compare the results of the welfare and egg yields of the birds under the different conditions.

THE YARDS.

The yards to most poultry houses are at the south, or on the sheltered sides of the buildings, to afford protection during late fall and early spring, when cold winds are common. The warmed house has yards on both north and south sides, with convenient gates. The south yards are used until the cold winds are over in spring, when the hens are allowed to go to the north yards, which are well set in grass sod. With the curtain-front houses the yards are on the north side only. The birds are kept in the building until the weather is suitable for opening the small doors in the rear wall. The necessity for getting

them out of the open-front house, where they are really subject to most of the out-of-door conditions during the daytime, is not so great as when they are confined in closed houses with walls and glass windows. The clear, open fronts of the curtain-front houses allow teams to pass close to the open door of the pens for cleaning out worn material and delivering new bedding, and also allow attendants to enter and leave all pens from the outside walk and reach the feed room without passing through intervening pens.

TRAP NESTS.

The trap nest in use at the Maine Station is original with this station. It is very simple, inexpensive, easy to attend to, and certain in its action. It is a box-like structure, without front, end, or cover, 28 inches long, 13 inches wide, and 16 inches deep, inside measure. A division board with a circular opening $7\frac{1}{2}$ inches in diameter is placed across the box 12 inches from the rear end and 15 inches from the front end. The rear section is the nest proper. Instead of a closely made door at the entrance, a light frame of 1 by $1\frac{1}{2}$ inch material is covered with wire netting of 1-inch mesh. The door is 10 inches wide by 10 inches high, and does not fill the entire entrance, a space of 2 inches being left at each side, to avoid friction. It is hinged at the top and opens up into the box. The hinges are placed on the front of the door rather than at the center or rear, the better to secure complete closing action. The trap consists of one piece of stiff wire about three-sixteenths of an inch in diameter and 22 inches long. This piece of wire is shaped so that a section of it, 11 inches long, rests directly across the circular opening in the division board, and is held in place by two loosely fitting clamps, the slots being long enough to allow the wire to work up and down about 3 inches. The next section of the wire is 8 inches long, and it is bent so that it is at right angles with the 11-inch section. It passes along the side of the box 11 inches above the floor, back toward the entrance door, and is fastened strongly to the wall by staples, but yet loosely enough so that the wire can roll easily. The remaining section of the wire, which is 3 inches long, is bent toward the center of the box, with an upward inclination, so that it supports the door when it is open and rests upon it. The end of the wire is turned over smoothly, forming a notch into which the door may slip when opened.

As the hen passes in under the open door and then through the circular opening to the nest, she raises herself so that her keel may pass over the lower part of the division board; at the same time her back presses against the horizontal wire as she passes it, and lifts it so that the end supporting the door slides from under it. Thus released, the door swings down and passes a wire spring near the bottom of the box at the entrance, which locks it and prevents the hen from escaping and others from entering.

The trap nests are placed four or more in a block, slide in and out like drawers, and can be carried away for cleaning when necessary. Four nests in a pen accommodate 20 hens, by the attendant going through the pens once an hour, or a little oftener, during that part of the day when the hens are busiest. Earlier and later in the day his visits are not so frequent. The double box with the nest in the rear is necessary. When a hen has laid an egg, and desires to leave the nest, she steps out into the front space and remains there until she is released. With only one section she would be likely to crush her egg by stepping upon it, and thus learn the pernicious habit of egg eating.

To remove a hen the nest is pulled part way out, and, as it has no cover she is readily caught, the number on her leg band is noted, and the proper entry is made on the record sheet. After having been taken off a few times the hens do not object to being handled; most of them remaining quiet, apparently expecting to be picked up.

Before commencing the use of trap nests it was thought that some hens might be irritated by the trapping operation and object to the noise incident to it, but such does not seem to be the case. The trap nests have been used at the Maine Station for Leghorns, Brahmas, Wyandottes, and Plymouth Rocks.

The amount of time required in caring for the trap nests can only be estimated, since the attendant's time is divided with other duties. The time varies from one day to another and with the number of nests in use. By noting the total time used each day in caring for the nests when the hens were laying most heavily, it has been estimated that one active person devoting his entire time to trap nests could take care of 400 to 500 nests used by 2,000 to 2,500 hens. When commencing the year's work he would need assistance in banding the birds, but after that was done he could care for the nests without assistance until midsummer, when the egg yields would probably be diminished and a part of his time could be spared for other duties.

FEEDING THE HENS.

For about twenty-five years the same family of Barred Plymouth Rocks has been carried at the University of Maine, and one way has been learned to feed and handle them to secure eggs and to avoid the losses from overfatness which are so common to mature hens of that breed. It is not claimed or thought that the methods of feeding here given are ideal; other methods may be as good or even better. These methods have, however, given good results at the Maine Station. While it is true that only the full-fed hen can lay to the limit of her capacity, it is equally true that full feeding of the Plymouth Rocks, unless correctly done, results disastrously.

Years ago the "morning mash," which was regarded as necessary to "warm up the cold hen" so she could lay that day, was given up,

and the mash was fed at night. The birds for several years prior to 1903 were fed daily throughout the year as follows: Each pen of 22 received 1 pint of wheat in the deep litter early in the morning. At 9.30 a. m. one-half pint of oats was fed to them in the same way. At 1 p. m. one-half pint of cracked corn was given in the litter as before. At 3 p. m. in winter and 4 p. m. in summer they were given all the mash they would eat up clean in half an hour.

The mash was made of the following mixture: 200 pounds of wheat bran, 100 pounds of corn meal, 100 pounds of wheat middlings, 100 pounds of linseed meal, 100 pounds of gluten meal, and 100 pounds of beef scrap. The mash was used with one-fourth its bulk of clover leaves and heads obtained from the feeding floor in the cattle barns. The clover was covered with hot water and allowed to stand for three or four hours. The mash was made quite dry, and rubbed down with the shovel in mixing, so that the pieces of clover were mixed in and became covered with the meal.

Cracked bone, oyster shell, grit, and water were placed before the chickens all the time. In winter two large mangolds were fed daily to the birds in each pen. They were stuck onto large nails which were partly driven into the wall a foot and a half above the floor.

Very few soft-shelled eggs were laid, and so far as known not an egg has been eaten by the hens thus fed.

The records of several years' feeding show that from 50 to 55 pounds of the dry materials of which the mash was made up were eaten by each hen in a year. The quantity of grain fed in the litter was the same every day, winter or summer. The quantity of mash was variable, being all they would eat in half an hour at the close of the day. They ate more in cold weather than in warm, also considerably more when they were laying heavily than when they were yielding few eggs.

The feeding above described was with hens in a house warmed by hot-water pipes, so that the temperature was above the freezing point at all times. The amount of feed required by the birds kept in this house for several years was always less during the winter season than for birds kept in the colder curtain-front houses.

In addition to the 50 to 55 pounds of meal in the mash, the hens in this house have averaged each year 18.2 pounds of wheat, 6.4 pounds of cracked corn, 5.8 pounds of oats, 5.9 pounds of oyster shell, 3.2 pounds of dry poultry bone, 2.9 pounds of mica grit, and 40 pounds of mangolds. The straw for litter has averaged 36 pounds per bird.

CRACKED CORN AND BEEF SCRAP AS A SUBSTITUTE FOR MOIST MASH.

In November, 1903, 300 pullets hatched in April and May were put into 6 pens in the open-front house, and the birds in all pens were selected so as to have the lots equal in quality.

One hundred and fifty of the birds (lot No. 1) were fed on dry grains in the litter during the day, and a full feed of moist mash was given toward evening. The mash was made as above described.

The other 150 birds (lot No. 2) were fed the same quantities and kinds of dry grains in the litter, but instead of moist mash they were given all they would eat of dry cracked corn in troughs at evening. Dry beef scraps were kept within their reach at all times. Both lots were constantly supplied with oyster shell, dry crushed bone, and grit. Mangolds were fed through the winter, and when the runs were bare in summer other green feed was supplied.

The materials used by each lot during the full year averaged per bird as follows:

Lot No. 1, with mash.—Mash, 53.3 pounds; wheat, 23.8 pounds; cracked corn in litter, 7.7 pounds; oats, 6.9 pounds; oyster shell, 8.5 pounds; bone, 4.4 pounds; grit, 4.2 pounds; mangolds, 40 pounds; straw, 36 pounds.

Lot No. 2, without mash.—Cracked corn, 45.4 pounds; wheat, 23.8 pounds; cracked corn in litter, 7.7 pounds; oats, 6.9 pounds; oyster shell, 4.4 pounds; bone, 1.7 pounds; grit, 2.9 pounds; beef scrap, 14.7 pounds; mangolds, 40 pounds; straw, 36 pounds.

Cost of feed and straw: Lot No. 1, \$1.73; lot No. 2, \$1.69.

Cost of feed without mangolds: Lot No. 1, \$1.48; lot No. 2, \$1.43.

Eggs yielded: Lot No. 1, 151; lot No. 2, 149.

Comparisons of the costs of the two rations and the egg yields of the birds fed upon them do not show very great advantages of one ration over the other. There were no marked differences in the appearance and health of the birds in the two lots; both were in good general health. The free use of cracked corn cheapened the cost of the ration, and the egg yield was not depressed sufficiently to indicate that this ration was faulty in its production. When compared with the feed required for a hen for one year in the warmed house, which was about 95 pounds, the 109 pounds used in this test is an increase of nearly 15 per cent.

As the birds in each house laid about the same number of eggs, it seems reasonable to suppose that the excess of feed was needed for maintenance in the colder house, where the birds were in outdoor temperature during the daytime throughout the year.

Although as many eggs were yielded by the birds eating less feed in the warmed house, the greater vigor and smaller loss among birds in the open-front house more than compensated for the increased cost of maintenance.

DRY FEEDING.

The comparison of moist mash with cracked corn and beef scrap indicated that the moist mash was not essential to egg production. Beginning the 1st of November, 1903, 550 pullets hatched in April

and May were fed wholly on dry feed. They were in the curtain-front houses, with warm, elevated roosting closets and in flocks of 50, 100, and 150. At 5 o'clock in the morning the flocks of 50 birds were given 2 quarts of cracked corn; at half past 10 o'clock they had 1 quart of wheat and 1 quart of oats. This dry material was all spread on the litter on the floor, but was not raked in. Along one side of the pens were feed troughs with slatted fronts, in which was kept a supply of the dry material of which the moist mash, before described, was composed. These troughs were never allowed to remain empty when the supply was exhausted. The dry mash was constantly within the reach of all birds and they helped themselves at will. Oyster shell, dry cracked bone, grit, and charcoal were accessible at all times. A moderate supply of raw mangolds and plenty of clean water was furnished. When the birds were first put upon this ration they were not acquainted with the dry mixture in the troughs and ate of it sparingly, but in three or four days they were using as much of it as at any time, except when laying heavily. When the feeds of cracked corn, wheat, and oats were given, the birds were always ready and anxious for them, and would scratch in the litter for the very last kernel before going to the troughs, where an abundance of feed was in store. It was very evident that they liked the broken and whole grains better than the mixture of the fine materials, yet they by no means disliked the latter, for they helped themselves to it—a mouthful or two at a time—whenever they seemed to need it, and never went to roost with empty crops, so far as we could discover. They apparently did not like it well enough to gorge themselves with it and sit down, loaf, get overfat, and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mashes in troughs.

The weights of the feed eaten were accurately kept for the month of March, 1905. During the 31 days of that month the 550 birds consumed on the average the following materials per bird: Cracked corn, 2 pounds; wheat, 1.09 pounds; oats, 0.81 pound; mash, 5.68 pounds; shell, 0.52 pound; bone, 0.25 pound; grit, 0.31 pound; mangolds, 3.30 pounds.

The average egg yield of the birds in flocks of 50 and 100 was 147 eggs for each hen for the year ending October 31, 1905. The dry feeding, as judged by the health of the birds and the egg production, is fully as satisfactory as when the moist mash is used. The dry method has some advantages and apparently no disadvantages. The dry mash is put in the troughs at any convenient time, only guarding against an exhaustion of the supply. There is an entire avoidance of the scrambling and crowding that always occur at trough feeding when that is made a meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted, as is

common when a full meal of mash is given at night, and the labor is much less, a person being able to care for more birds than when the regular evening meal is given.

SIZE OF FLOCKS AND HOUSING SPACE.

The cost of housing poultry is a very important item to the poultryman, and the amount of floor space required by each hen is a question much discussed and worthy of the most careful consideration and investigation. This question is being studied by the Maine Station in cooperation with the Bureau of Animal Industry. While it is still too early to give positive conclusions, an outline of the work under way and some of the results thus far found will have an interest and some value.

The conditions laid down years ago and accepted as imperative that hens could only be kept profitably as layers in flocks of not more than 15, with an allowance of at least 10 square feet of floor space for each bird, required large space for small numbers of birds, and the system was expensive. The small pen, even though containing but few fowls, means close confinement to the occupants. If one hen were confined and compelled to remain on the generous allotment of a square yard, life would be very unsatisfactory to her. But give her 25 square yards of floor room to roam over at will and she will be happy, although she may meet 49 neighbors in her wanderings and divide the room with them; yet the allotment per individual hen is reduced to one-half a square yard.

Each of the pens in house No. 1 has 160 feet of floor space. When occupied by 22 birds each individual has a floor space of 7.3 square feet. Each of the 7 pens in house No. 2 has 240 square feet of floor space, giving each of the 50 pullets 4.8 square feet.

In house No. 3 the four pens are twice as large as those of house No. 2, each containing 480 square feet. In each of two of the pens 100 pullets are kept, having 4.8 square feet of floor space to a bird—just the same allotment that is given in the pens of 50 birds in the No. 2 house. The 150 birds kept in each of the two other pens have only 3.2 square feet to a bird.

Some of the questions upon which it is hoped to get light by these comparisons are: Does the larger room have advantages over the smaller one, when the average floor space to a bird is the same, by giving greater opportunities and freedom to the birds? Are there disadvantages when the number of birds in the flock is increased, the proportioned floor space per bird remaining the same?

Should the tests indicate that the greater liberties of the larger pens are advantageous, the question arises: Are the advantages such that the number of birds in the large pens can be increased and the ratio of egg production be maintained? Also, how far can the net profit

from the pens be increased by increasing the number of birds in each pen, although the average egg yield be diminished by the greater density to which the pens are occupied?

So far as health and egg production are concerned, thus far there is little to choose between the pens containing 22, 50, and 100 birds, with 7.3 and 4.8 square feet to a hen. The fowls in the 150-bird pens, for reasons which are not attributed to the increased numbers or diminished floor space, did not do as well in 1904-5 as those in the other pens.

With pens of the same style and arrangement, and birds matched in age, development, and breed, with the same system of feeding and attendance, and with experiments with large numbers of birds and extending over a number of years, it is hoped to obtain data regarding the sizes of rooms and numbers in flocks which may be of great value to the poultry industry of the country.